AGGREGATE RESOURCES IN THE WINNIPEG RIVER PLANNING DISTRICT

MINERAL RESOURCES DIVISION

AGGREGATE RESOURCES SECTION

Manitoba
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AGGREGATE RESOURCES IN THE WINNIPEG RIVER PLANNING DISTRICT

RESOURCE MANAGEMENT AND PIT REHABILITATION PROPOSAL: FOR LAND USE PLANNING

DEPARTMENT OF ENERGY AND MINES
MINERAL RESOURCES DIVISION

NOVEMBER 1984

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ABSTRACT

Aggregate resources are an essential commodity required to support present and future construction-related activities. This non-renewable commodity, under present engineering technology, has no suitable substitute for most end uses. Aggregate is characterized by a low intrinsic value, a high bulk, and a delivered price that is highly sensitive to transportation costs. The economics of production dictate that mineral extraction be located as close to the construction site as possible. In light of the scarcity of quality aggregate resources, safeguards are needed to conserve the existing supply.

This aggregate resource management proposal has been compiled in order to facilitate regional land-use planning activities in the Winnipeg River Planning District. The report contains background information as well as resource planning recommendations concerning the conservation of this valuable resource.

The aggregate resource base of the Winnipeg River Planning District are located in Quaternary eskers, kames, moraines and Lake Agassiz beach deposits as well as Precambrian granite outcrops. An estimated total of 8 227 000 cubic metres of sand and gravel resources have been assigned a Stop Development Status in the background report. The general intent of this designation is to protect the resource for future construction requirements. Also, an estimated 2 140 000 cubic metres of aggregate have been designated as Caution Development Status. These deposits are of lower quality or have not been adequately tested; however, they are significant in terms of future aggregate resource potential of the region.

It is recommended that all deposits assigned a Stop Development Status be protected from conflicting land uses until the resource is mined to depletion and the site rehabilitated.

TABLE OF CONTENTS

		Page
1.1	Introduction	1
1.2	Objectives	2
1.3	Significance of Aggregate Resource Management	4

SECTION 2

2.1	Introduction	8
2.2	Precambrian Geology	8
2.3	Ordovician Geology - Winnipeg Formation	9
2.4	Quaternary Morphology and Stratigraphy	10
2.5	Quaternary History	11

SECTION 3.0

3.2	Introduction	14
3.2	Demand for Sand and Gravel	14
3.3	Recommended Planning Status of Mineral Resource Areas	19
3.4	Conclusion	20

LIST OF TABLES

		Page
Table 1.1	Sand and Gravel uses in Manitoba	5
Table 3.1	Estimated Annual Demand for Sand and Gravel in the Local Government District of Alexander	17
Table 3.2	Examples of Construction Activities dependent upon Sand and Gravel	18
Table 3.3	Recommended Planning Status of Sand and Gravel Deposits in the Local Government District of Alexander	22
Table 3.4	Recommended Planning Status of Pre-cambrian Granite Outcrops and Quarries in the L.G.D. of Alexander	23

LIST OF FIGURES

Figure 1.1: L.G.D. of Alexander Planning District 3

LIST OF MAPS

MAP 1 (in pocket): Aggregate and Quarry Mineral Resources in the L.G.D. of Alexander

MAP 2 (in pocket): Metallic Mineral Resource Potential of the L.G.D. of Alexander

LIST OF APPENDICES

APPENDIX 1: Provincial Land Use Policy #13, Manitoba Regulation 217/80 of the Planning Act.

APPENDIX II: Mining Aggregate as a Land Use.

APPENDIX III: Examples of Aggregate Resource Data available for the L.G.D. of Alexander.

SECTION 1

1.1 INTRODUCTION

Aggregate and quarry mineral resources are an essential commodity required for present and future construction-related activities in Manitoba. This resource, under present engineering technology, has no suitable substitute. It is an essential ingredient for all construction projects including hospitals, homes, educational and transportation facilities. Aggregate and quarry mineral resources are a large volume, high bulk, low-cost products. The inavailability of local quality aggregate deposits can act as an economic constraint on present and future construction requirements. The problem of limited availability of aggregate deposits is compounded by increased development pressures around urban centres and expanding aggregate requirements for construction-related activities. The primary objective of this resource management proposal is to provide technical input concerning sand and gravel and quarry minerals conservation as a component of the L.G.D. of Alexander Development Plan. The management of sand and gravel and quarry mineral resources, based upon Provincial Land Use Policy #13, is important for present and future construction activities in Manitoba. The information contained in this report provides for an estimation of potential mineral resources available as well as recommendations concerning the conservation of the resource.

1.2 OBJECTIVES

The objectives of this aggregate and quarry mineral resource management report are:

(1) To outline the primary sources of information for aggregate resource management.

(2) To provide a general geologic history of the L.G.D. of Alexander.

(3) To provide a comprehensive resource inventory of aggregate and quarry mineral resources in the L.G.D. of Alexander.

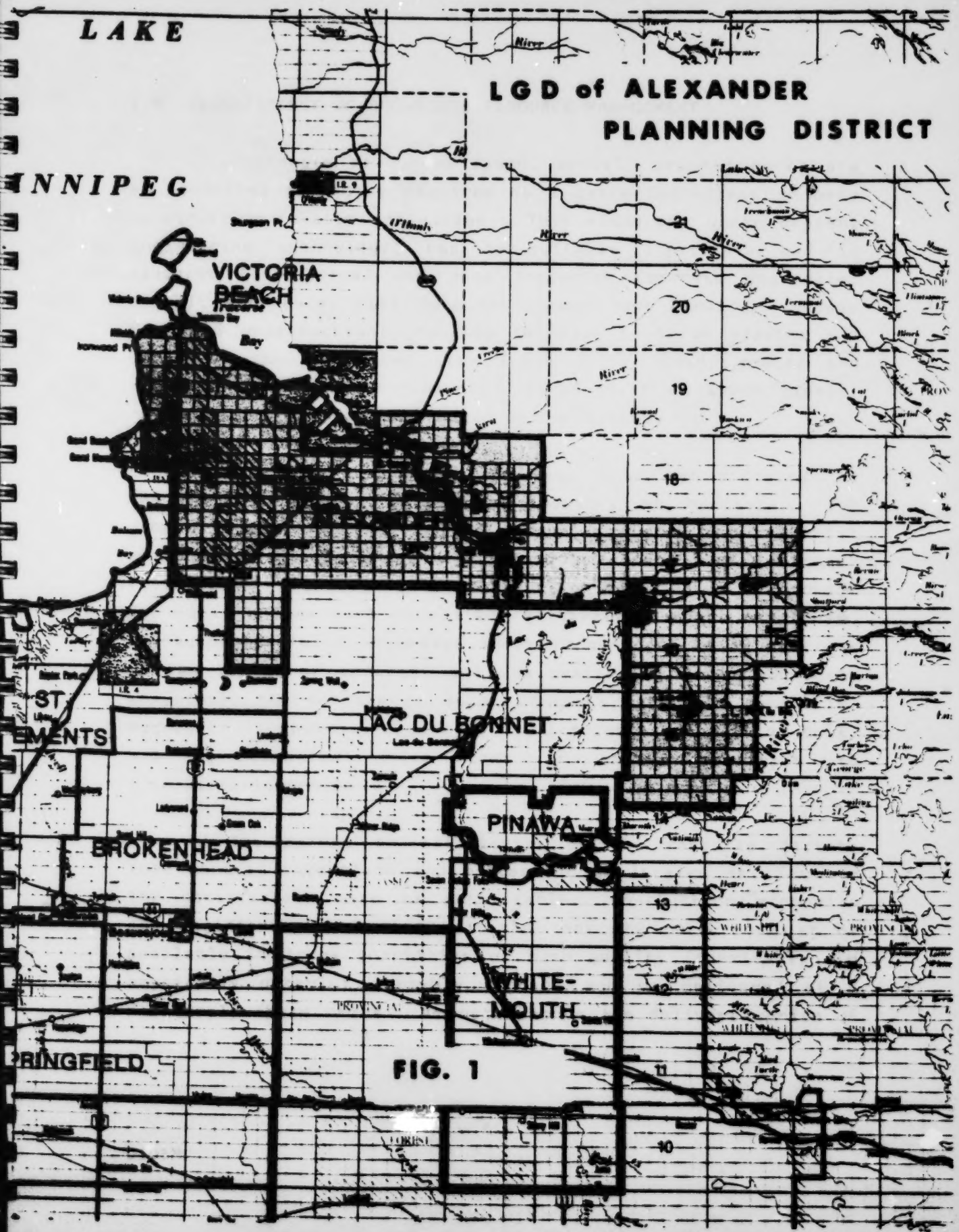
(4) To provide a general economic analysis of the regional supply and demand conditions over a 25-year planning horizon.

(5) To delineate the significance of aggregate and quarry minerals to municipal councils, regional land use planners, industry and the public.

(6) To provide information concerning mining of aggregate as a land use and rehabilitation requirements of depleted pits.

(7) To provide information concerning mineral dispositions and land tenure.

(8) To provide aggregate and quarry mineral resource planning recommendations based upon Provincial Land Use Policy #13, Manitoba Regulation 217/80 of the Planning Act.


LAKE
NNIPEG
LGD of ALEXANDER
PLANNING DISTRICT
VICTORIA
BEACH
ST.
EMENTS
LAC DU BONNET
PINAWA
BROKENHEAD
WHITE-
MOUTH
PRINGFIELD
21
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19
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13
12
11
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FIG. 1

1.3 SIGNIFICANCE OF AGGREGATE RESOURCE MANAGEMENT

Aggregate resources (sand, gravel, crushed rock) are an essential commodity required as a basic ingredient in many construction-related activities. This resource, under present engineering technology, has no suitable substitute and is required for typical end uses including concrete aggregate, asphalt aggregate, fill purposes (sewer pipe bedding, subbase for road construction), railway ballast, sand for plaster and numerous other end uses (see Table 1.1). Sand, gravel and crushed rock are a non-renewable, fixed position common mineral resource which cannot be created or replaced by man.

The sand and gravel industry, by volume produced, is the largest mineral extraction industry in Manitoba. The common mineral aggregate (sand, gravel, crushed rock) consist of inert fragments which when added to cement form concrete. Their primary function as a construction material is to provide for bulk, and as such should be relatively abundant and cheap. Aggregate generally comprises about 70 per cent to 80 per cent of the volume of concrete and the quality of local aggregate influences the quality of local concrete materials available. Aggregate is characterized by a low intrinsic value, high bulk, and a delivered price that is highly sensitive to transportation costs.

The market characteristics of the resource dictate that mineral extraction and processing be located as close to the construction site as permissable. Constuction economics and engineering technology dictate that the resource must be available in large quantities of high quality (chemically and physically durable) variably graded, and be delivered at a relatively cheap price. As noted above the delivered price of

TABLE 1.1

Construction Type	End Use
Road construction	subbase base traffic (surface) gravel shoulders culvert fill maintenance (pit run) ice control
Concrete Aggregate	road surface dams foundations building ready-mix sidewalks pre-cast blocks, tiles mortar grout
Asphalt Aggregate	road surfacing parking lots
Railway Construction	subbase ballast
Fill	sewer and water pipe bedding septic field construction rip-rap dam construction

the commodity is highly sensitive to transportation costs, and by sterilizing aggregate deposits prior to depletion can add significant increased local construction costs due to increased haulage distances required.

Society faces, at the present time, increased population levels and expanding economic growth rates which require, in the long run, significant volumes of quality aggregate material. To provide the future population with homes, transportation facilities, educational institutions, employment opportunities, society must build and maintain increasing numbers of physical facilities. One siginificant resource problem that faces the construction industry is the depletion of higher quality deposits over time.

The aggregates are given a quality classification dependent upon their chemical and physical durability required for a specific end use. In order for a pit to supply the required material for a construction project, it must be of suitable quality defined by the end use engineering specification. For example, the Manitoba Department of Highways has end use specifications that a gravel resource must meet in order to be utilized for asphalt aggregate.

In general terms the aggregate is produced at the pit or quarry (supply point) and transported to the construction site (demand point) where they are utilized for construction of buildings, roads, bridges and other engineering projects. The delivered price per ton reflects the cost of material, processing, transportation costs, fixed costs of amortizing the processing plant, royalties, profits and future costs of land reclamation. Sterilization of this non-renewable resource can

lead to significant future increases in delivered price due to longer haulage distances required.

Sand and gravel and crushed stone can be used interchangeably when their quality and delivered price are comparable. Sand and gravel is produced from open pits located in a gravel deposit and processing normally consists of washing, screening, crushing to various sizes and stockpiling. In some cases unprocessed sand and gravel (pit run) is moved and sold for fill or sub-base material in highway construction.

Crushed stone, however, is produced from open quarries in the bedrock and processing includes drilling, blasting, crushing, screening, washing and stockpiling. Crushed stone is generally more expensive to produce than sand and gravel due to the increased processing and handling required.

SECTION 2.0

GEOLOGY OF THE LOCAL GOVERNMENT DISTRICT OF ALEXANDER

2.1 INTRODUCTION

This section will briefly describe the historical geology and stratigraphy of the local government district of Alexander. The general bedrock geology and stratigraphy consists of basement Precambrian granites and granite gneisses, in the western portion of the local government district, and part of the Bird River greenstone belt in the eastern part. The Precambrian bedrock is overlain by the Ordovician Winnipeg Formation sandstone near the shore of Lake Winnipeg and, in turn, overlain by Quaternary deposits of clay, till, silt, sand and gravel. The objective of Section 2 is to provide a geologic framework that will aid in delineating the resource potential of aggregate available for mineral extraction.

2.2 PRECAMBRIAN GEOLOGY

The Precambrian bedrock geology, in the local government district of Alexander, consists of the Pine Falls Plutonic Complex, Bird River Greenstone Belt, and the Lac du Bonnet Pluton (McRitchie, 1971). The Pine Falls Plutonic Complex forms extensive tracts of undifferentiated rocks throughout the western half of the government district. The rocks consist predominantly of quartz monzonite that has undergone complete recrystallization. In the Great Falls region, large, homogeneous intrusions of quartz diorite, with local intrusions of granodiorite, extend westward toward Stead and east towards Round Lake.

The synclinal Bird River greenstone belt consists of basic volcanics and overlying impure quartzite, arkose, slate and chert (McRitchie, 1971). It also includes the intrusive Bird River Sill which is differentiated from granophyric gabbro, through anorthositic gabbro to peridotite. The Bird River Sill and associate greenstone belts contain known mineralization including copper, pyrite, tin, beryl, lithium, nickel and chrome. The resource potential for mineral development is high, and, in the future, much mineral exploration and development is anticipated.

The Lac du Bonnet quartz monzonite pluton occupies the area surrounding Lac du Bonnet. The pluton is considered to be an important regional tectonic unit because of its large size (2,500 km^2) and its structural location. Outcrops that occur within the pluton have been utilized for quarries for crushed stone for highways construction.

2.3 ORDOVICIAN GEOLOGY - WINNIPEG FORMATION

The Ordovician Winnipeg Formation strikes generally north-south and transects the western boundary of the Local Government District of Alexander. The Ordovician Winnipeg Formation has been subdivided into a basal sandstone unit overlain by a complex sequence of quartzose, sandstone and shale. The basal sandstone unit consists of a poorly consolidated, well-rounded and frosted quartzose sand that is overlain by a 10.6 metre unit of interbedded shale and sand. The shale is greenish grey and, in part, sandy and silty. Between these two units is a thin zone containing pyrite nodules.

2.4 QUATERNARY MORPHOLOGY AND STRATIGRAPHY

The dominant morphological feature in the L.G.D. of Alexander is the Belair Moraine. The moraine extends from Victoria Beach in the north to Gull Lake in the south and Stead in the east. It attains a maximum elevation of approximately 295 metres and relief of 40 to 50 metres is common. The moraine is flanked by a clay and till plain which is, in part, disrupted by granite knolls. The Quaternary stratigraphy in the Belair Moraine consists of white sand overlain by two till units - glaciofluvial sand and gravel - and glacial Lake Agassiz sediments.

The oldest Quaternary unit outcropping in the Belair Moraine is a white glaciofluvial sand. Drill hole information indicates that the core of the moraine is predominantly white sand; however, the sediments associated with the white sand are variable, ranging from finely laminated sand and silt to stratified gravel. The white sand is approximately 85% silica and is well sorted. The paleocurrent direction of the unit is southerly.

Overlying the white sand are two, discontinuous till units that are generally less than 2 m thick. The older till has an average composition of 70% sand, 22% silt, and 8% clay and a pebble composition that is 50% Precambrian clasts. The younger till can be differentiated by a higher silt and clay content (47% sand, 38% silt, and 16% clay) and by a lower Precambrian clast content (25% Precambrian).

Glaciofluvial sand and gravel is stratigraphically positioned between the till units and the overlying glacial Lake Agassiz sediments. The glaciofluvial sands and gravels

are located in the upland areas and are of limited areal extent. Bedding is generally massive and horizontal; however, the finer facies are commonly cross-bedded. The thickness of the unit varies from 2 to 8 metres.

Stratigraphically positioned above the glaciofluvial gravel unit are glacial Lake Agassiz sediments. The sediments vary from silt and clay plains to sand and gravel ridges. The silt and clay is located predominantly in the flatter, low-lying areas whereas the sand and gravel deposits are located predominantly in the morainal areas of greater relief.

2.5 QUATERNARY HISTORY

During quaternary time numerous cycles of ice advance and retreat occurred. Continental ice sheets caused extensive erosion of the underlying bedrock and deposited the material as till and associated sediments. Each glacial cycle was terminated by a non-glacial interval consisting of a period when the landscape was ice-free. The landscape, however, was modified by each subsequent ice advance, and the present landscape is primarily the result of the last glacial episode - the Wisconsin Stage.

The present landscape in the L.G.D. of Alexander is attributed to two late Wisconsin ice sheets, that is, an ice sheet of northeastern provenance (Rainy Lobe) and an ice sheet of northwestern provenance (Red River Lobe). The first ice advance during the last glacial episode (Rainy Lobe) flowed southwest over the Precambrian Shield depositing unsorted, sandy, Precambrian-rich till and terminated in the northern United States. During the regression of the Rainy Lobe the ice

front stabalized in the vicinity of the Belair Moraine where it met ice of the Red River Lobe. The Red River Lobe had contemporaneously advanced southeast over the Paleozoic carbonates of the Interlake region. At the confluence of these ice sheets, prior to 14 000 years B.P. (Before Present), white sand and associated morainal sediments were deposited by meltwater flowing southward between the two lobes (Teller and Fenton, 1980).

The Red River Lobe readvanced over the Belair Moraine depositing a silty carbonate-rich till. The ice sheet advanced as far south as Des Moine, Iowa, approximately 14 000 B.P.

With glacial ice to the north blocking the natural drainage, meltwater was trapped at the southern ice margin. As the Red River Lobe retreated northward, a pro-glacial lake formed, termed 'Lake Agassiz' draining south into the Mississippi River. During the early stage of Lake Agassiz, 10 000 to 12 000 B.P. the Red River Lobe retreated further northward into southern Manitoba. Quaternary stratigraphy in southern Manitoba suggests that the retreat of the Red River Lobe was followed by several minor readvances into the lake (Teller and Fenton, 1980).

Matile (1984) has suggested that the stratigraphy within the regional moraines indicates that the Rainy Lobe was the last glacial ice to retreat from the area. Before retreating, the Rainy Lobe deposited the Precambrian-rich glaciofluvial sand and gravel which caps small areas of the moraine. This unit comprises the majority of the higher quality sand; gravel deposits in the L.G.D. of Alexander was deposited approximately 9 900 years B.P.

As the Rainy Lobe retreated into northwestern Ontario, approximately 11 000 years B.P., the eastern outlets of Lake Agassiz, in the Lake Nipigon area, opened for the first time, and 2 000 years later, about 9 100 B.P. (Nielsen et al., 1982), for a second and final time. As Lake Agassiz drained, shoreline features such as beaches and spits were formed throughout the area. The present-day Lake Winnipeg and Lake Manitoba are remnants of former glacial Lake Agassiz.

SECTION 3.0

AGGREGATE RESOURCES IN THE WINNIPEG RIVER PLANNING DISTRICT

3.1 INTRODUCTION

The objective of Section 3 is to provide detailed background information in order to develop a resource management policy concerning aggregate, quarry minerals, and metallic minerals for the Winnipeg River Planning District. The aggregate resource planning recommendations provided concerning this valuable non-renewable resource reflect the general nature of the supply and demand considerations over a 25-year planning horizon. Specific resurce topics include general information on the market characteristics of aggregate, end use requirements, and resource planning recommendations based upon Provincial Land Use policy #13, Manitoba Regulation 217/80 of the Planning Act.

3.2 DEMAND FOR SAND AND GRAVEL

The demand for sand and gravel in the Winnipeg River Planning District is tied closely to activity in the construction sector. This type of relationship between an input and output of a final product is referred to as derived demand where the sand and gravel is produced to meet the required needs of the construction industry, with most aggregate consumed in highway and road construction. Consequently, the demand or extraction rate is a function of end use requirements and is directly related to the level and mix of regional construction-related activities.

The long-term demand for sand and gravel is highly inelastic primarily because there is no engineering substitute for most end uses. Sand and gravel resources are a large volume, low-cost mineral resource in Manitoba for which one can identify a continuing demand and a diminishing availability. In time, as roads and buildings deteriorate, new high quality sources of gravel will be required to facilitate renewal of existing structures as well as supply the essential ingredients in new forms of social and private capital.

One important resource planning concept is the relationship between quality, quantity demanded, and delivered price. As higher quality deposits are depleted or sterilized by surface land uses, lower quality deposits will become significantly more valuable. In addition, the long-term maintenance costs may rise significantly as the quality of the resource diminishes.

The aggregate resource base of the Winnipeg River Planning District are required to support regional construction-related activities in the L.G.D. of Alexander; Villages of Powerview, St. George and Great Falls; and for Manitoba Hydro Construction purposes. The local government district has been extensively explored, in the past, and has supported large-scale aggregate extraction over the years, particularly in the Belair Moraine area.

The estimated demand for aggregate resources is based on consideration of:

(1) Department of Highways upgrading and improvements for the next 25 years in the local government district of Alexander.

(2) Requirements for the local government district of Alexander.

(3) Requirements for Manitoba Hydro; and

(4) Requirements for redi-mix concrete producers and other private interests.

The estimated demand is presented in Table 3.1

TABLE 3.1

Estimated Annual Demand for Sand and Gravel
in the Local Government District of Alexander
(m^3)

End User	1 Year	25 Years
Department of Highways	135 520	3 338 000
L.G.D. of Alexander	9 000	225 000
Manitoba Hydro	2 500	62 000
Private (Redimix Concrete, other)	30 000	750 000
TOTAL	177 020	4 425 000

TABLE 3.2

Examples of Construction Activities dependent upon Sand and Gravel

Construction Type	End Uses
Engineering	Roads, dams, transmission lines, pipe lines, oil drilling, mine development
Residential	Single, seasonal, double, row apartments
Residential (improvements)	Additions, structural changes, residential garages, swimming pools - others.
Industrial	Manufacturing, processing, transportation, communication, utilities, agricultural, forestry, mine and mill buildings.
Commercial, Building Construction	Stores, warehouses, garages, office buildings, hotels, funeral parlours, beauty salons, miscellaneous commercial signs, posters, heating and plumbing installation.
Institutional	Community, Municipal, Provincial, schools, universities, hospitals, clinics, law enforcement, public protection, government offices, national defence, gymnastics, laundromats, heating plants, retirement homes.

The demand for sand and gravel in the Winnipeg River Planning District has been estimated to be 4 425 000 cubic metres of resource for a 25-year planning period. The gravel resources will be required to facilitate future construction-related activities that include concrete aggregate, asphalt aggregate, railway construction, and fill (see Table 3.2). Local consumption of aggregate include typical end uses, for example, municipal projects, septic field construction, foundations, and sidewalks. Highway improvements and maintenance include Provincial Trunk Highways, Provincial roads and municipal roads.

3.3 RECOMMENDED PLANNING STATUS OF MINERAL RESOURCE AREAS

The sand and gravel deposits and quarry mineral deposits are shown on Map 1 (in pocket). The resource information utilized in the background study is based on geologic mapping undertaken by the Mineral Resources Division in 1983. A total of 53 sand and gravel deposits were identified containing a total of 10 512 000 cubic metres of aggregate resource. Most of the recoverable sand and gravel resources available are located in the Belair Interlobate Moraine. The eastern part of the planning district has a scarcity of quality sand and gravel deposits. Consequently, Precambrian granite quarries have been utilized as a source of aggregate for road construction and for riprap along the Winnipeg River.

The following recommendations for protection of sand and gravel deposits in the Rural Municipality of L.G.D. of Alexander are designed to ensure that the supply of aggregate, which is required by the construction industry, municipalities and provincial agencies, is available for future use.

Land-use planning should recognize the potential for conflict between mineral resource extraction and other land uses (see Appendix II). Furthermore, land uses which may restrict or prohibit development of high quality sand and gravel deposits should not be allowed. In order to delineate mineral deposit areas in the Local Government District of Alexander, where conflicting land uses should be restricted, the Stop-Caution-Go development status of aggregate deposits is presented in Map 1 (in pocket) and Table 3.4.

This recommended deposit status is based on:

(1) size and quality of the deposit;

(2) past use of resource;

(3) location (in relation to access, transportation routes, and existing land holdings);

(4) the objectives for pit and quarry operation and rehabilitation, as outlined in Appendix III of this report; and

(5) the overall requirements of supply and demand for aggregate.

The Stop status indicates a valuable deposit upon which no conflicting land-use should be allowed. Conflicting land-uses would include housing (including subdivision of lots for residential use), or the imposition of highways or utility corridors over the deposit. Such development should be deferred until the resource is extracted and the site rehabilitated. The Caution status denotes a deposit whose full potential is not proven, or whose quality is not high, but has been recognized as valuable to a region. Deposits assigned a Caution status should be referred to the Mineral Resources Division when conflicting land uses occur. Deposits of either

low quality or those which contain uneconomic reserves are designated with a Go development status. These deposits are not generally important in terms of resource utilization.

TABLE 3.3

RECOMMENDED PLANNING STATUS OF SAND AND GRAVEL DEPOSITS IN THE L.G.D. OF ALEXANDER

DEPOSIT NUMBER	RESERVES (cubic metres)	RECOMMENDED PLANNING STATUS
4401	52 000	GO
4402	23 000	GO
4403	21 000	CAUTION
4404	60 000	CAUTION
4405	76 000	STOP
4406	61 000	STOP
4407	34 000	CAUTION
4408	64 000	CAUTION
4409	40 000	CAUTION
4410	826 000	STOP
4411	14 000	CAUTION
4412	51 000	STOP
4413	113 000	CAUTION
4415	2 371 000	STOP
4416	78 000	CAUTION
4417	58 000	CAUTION
4418	98 000	STOP
4419	16 000	CAUTION
4420	29 000	CAUTION
4421	684 000	CAUTION
4422	33 000	CAUTION
4423	18 000	CAUTION
4424	54 000	GO
4425	29 000	CAUTION
4426	25 000	CAUTION
4427	372 000	STOP
4428	25 000	CAUTION
4429	69 000	STOP
4431	183 000	CAUTION
4432	34 000	CAUTION
4433	238 000	STOP
4434	745 000	STOP
4435	1 595 000	STOP
4436	495 000	STOP
4437	140 000	STOP

DEPOSIT NUMBER	RESERVES (cubic metres)	RECOMMENDED PLANNING STATUS
4438	603 000	STOP
4439	170 000	STOP
4441	211 000	CAUTION
4442	52 000	GO
4443	53 000	CAUTION
4444	60 000	CAUTION
4445	8 000	CAUTION
4446	61 000	CAUTION
4447	67 000	CAUTION
4448	47 000	CAUTION
4449	13 000	CAUTION
4450	61 000	STOP
4451	59 000	STOP
4452	197 000	STOP
4453	38 000	CAUTION
4454	24 000	CAUTION
TOTAL	10 548 000	

TABLE 3.4

RECOMMENDED PLANNING STATUS OF PRECAMBRIAN GRANITE OUTCROPS AND QUARRIES IN THE L.G.D. OF ALEXANDER

Location	Recommended Planning Status
NE 1/4-26-18-10E	Caution
NW 1/4, l.s. 1, 2, 3, 5, 6, 7, 8-35-17-11E	Caution
l.s. 4-35-17-11E	Stop
l.s. 14, 15, 15, -25-17-11E	Caution
l.s. 13-25-17-11E	Stop
E 1/2-2-17-11E	Caution
SE 1/4-4-17-11E	Caution
SW 1/4-4-17-11E	Caution
E 1/1-28-16-13E	Caution

3.4 CONCLUSION

An estimated total of 8 227 000 cubic metres of sand and gravel resources have been assigned a Stop Development Status in the Local Government District of Alexander. In comparison, an estimated 4 425 000 cubic metres of resource will be required to facilitate construction-related activities during the next 25-year planning period. The eastern portion of the local government district has a scarcity of quality gravel deposits and, consequently, existing Precambrian granite outcrops and quarries will be required for road construction purposes and riprap along the Winnipeg River.

It is recommended that all deposits assigned a Stop Development Status be protected from surface land uses that would restrict their future development until the resource is mined to depletion.

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APPENDIX I

MANITOBA REGULATION 217/80

OF THE PLANNING ACT

POLICY #13

ECONOMICALLY VALUABLE AGGREGATE AND QUARRY MINERAL DEPOSITS SHOULD BE PROTECTED FROM SURFACE LAND USES THAT WOULD INTERFERE WITH THEIR ONGOING AND FUTURE EXPLOITATION.

A. Policy Objectives

The objectives of this Policy are:

(a) To protect aggregate and quarry mineral resources for future construction and development in the Province.
(b) To ensure that materials are available to support local and provincial construction needs and industrial minerals production at a reasonable cost.
(c) To ensure that pit and quarry operations are reasonably compatible with adjacent land uses.
(d) To integrate aggregate and quarry mineral extraction into the overall land use planning process by allocating areas specifically for extraction and by assuming that as the economic climate changes so areas allocated to resource extraction will also change.
(e) To pursue sequential land use practices such that on a known deposit (i) a non-conflicting land use is applied to the surface of the deposit prior to mineral extraction, and (ii) the land is returned to a practical and compatible use once extraction has ceased.

B. Policy Application

Deposits of sand and gravel and near-surface limestone which are in demand as construction materials by industry, local communities or government departments and agencies, should be protected. In certain parts of the Province such minerals as bentonite, shale, gypsum, high calcium limestone, silica sand and other quarry minerals should also be protected to ensure a supply of these materials to industrial mineral related industries. These include both surface deposits and shallow subsurface deposits overlain by till or clay.

For the purpose of this Policy:

(a) Conflicting land uses include residential subdivision lots, highways or utility corridors. Such development should be deferred until the mineral is extracted and the site rehabilitated.
(b) Marginally conflicting land uses include the incorporation of aggregate and quarry mineral deposits into a Provincial or National Park, a Wildlife Management Area, a Community Pasture or a Provincial Forest or the establishment of a garbage dump on part of a deposit. In these cases, mineral extraction can take place alongside the alternative land use, provided that agreement is reached between the two concerns, to ensure optimal utilization of all resources involved.
(c) Non-conflicting land uses include recreation outside of Provincial Parks, low value timber stands, general agricultural practices and temporary occupation, such as trailer parks or parking lots. Pit and quarry operations can develop in these areas whenever such activities become economically feasible.

In some areas aggregate or quarry mineral extraction should be recognized as a primary land use. In other areas a marginal or non-conflicting land use may be permitted providing that it could later be converted to a gravel or mineral extraction operation.

In order to indicate areas where conflicting land uses should be disallowed, the Mineral Resources Division is in the process of producing aggregate and quarry mineral resource maps for certain regions of the Province. These will take the form of "Stop – Caution – Go" maps. "Stop" indicates valuable deposits upon which no conflicting land use should be allowed. "Caution" denotes a deposit whose full potential is not proven or whose quality is not high but which has been recognized as of value to the region. Deposits with a status of "Caution" may be designated for a conflicting land use, after local needs have been scrutinized. "Go" denotes a deposit of no present recognized value as an aggregate or quarry mineral source. Periodic revision to the "Stop – Caution – Go" status of deposits will reflect continuing exploration and changing economic

conditions. It is understood that the maps will be subject to approval by the Provincial Land Use Committee.

The rehabilitation of pits and quarries on both Crown and private land is governed by Regulation under The Mines Act. The rehabilitation takes place in accordance with an approved plan. Concensus for the plan is derived from concerned Municipal and Provincial agencies. The Mineral Resources Division requires such plans from all commercial operators.

Following mineral exploitation and rehabilitation, the land can be restored to some compatible use.

C. Definitions

For the purpose of this Policy:

(a) "Aggregate" means sand, gravel, or both, or crushed rock.

(b) "Economically Valuable Aggregate and Quarry Mineral Deposits" means those areas of aggregate and quarry mineral resource which have a high potential for extraction based on supply and demand projected over 25 years.

(c) "Quarry Minerals" means those minerals obtained by quarrying, including shale, kaolin, bentonite, gypsum, clay, silica-rich sand, peat, salt, coal, and rock or stone used for any purpose other than as a source of metal, asbestos, potash, oil and natural gas.

APPENDIX II

MINING OF AGGREGATE AS A LAND USE

MINING OF AGGREGATE MINERALS AS A LAND USE

1.0 INTRODUCTION

Pits and quarries represent a unique land use warranting special consideration in the preparation of any municipal development plan. This status may be attributed to the following inherent characteristics of surface mining:

(i) The fullest possible exploitation of mineral reserves in proximity to the market is desirable since aggregate products are non-renewable and essential to our society..

(ii) As both a land use and a user of land, open surface mines can create environmental conflicts affecting adjoining property. By its very nature surface mining can be a source of noise, dust, vibrations, vehicle (truck) traffic, steep embankments, dangerous open water conditions, and general visual degradation.

(iii) Upon discontinuation of excavation, alternative uses for the mine landscape must be considered. Pits and quarries are an interim land use. The large-scale manipulation of the landscape to win aggregate deposits can present opportunities

which enhance the potential for subsequent land uses. While it may be impossible to totally restore the pre-mining conditions of a site, it may be even more advantageous to exploit these new opportunities.

2.0 Mining Dispositions and Land Tenure

2.1 Responsibility for Rehabilitation:

The requirements of The Mines Act and any of its regulations are binding upon the operator of a mine and the owner or lessee of the mineral rights, who initiates the mining and derives the main benefits of any returns. This may exclude the owner of surface rights, if he does not hold the mineral rights. Although the mineral and surface rights are commonly held together, there are instances where they have been separated in previous transactions or to facilitate mining. There are locations, for example, where the Crown holds one but not the other.

Manitoba Regulation 226/76, which sets out rehabilitation requirements, applies only to those pits and quarries which have been worked since January 1977. This authority is not binding for mines worked out prior to this date.

2.2 Pits and Quarries on Crown Land vs. Private Land

Where the Crown owns the surface rights, the condition of the post mining landscape is of direct concern since the Crown is responsible for subsequent use of the site. Consequently, provincial agencies take an active role in the preparation of mining and rehabilitation plans for such mines.

The disposition of mining rights on Crown land may be handled in any of two ways:

(i) A "Casual Permit" or a "Permission to Remove" may be obtained from the Mineral Resources Division to remove a specific quantity of aggregate from a specific site.

(ii) A "lease" may be obtained for a period of ten years (renewable) on lands open for staking.

On privately owned land, the advantages of developing a productive post-mining land use are returned largely to the holder of surface property rights, in the form of both ongoing productivity and increased equity. Consequently, the main focus of concern for provincial authorities in these instances is to ensure that adjoining property will not be detrimentally affected by the mining activity, and that any hazards to the public are minimized.

In recognition of these characteristics, regulations have been enacted under The Mines Act since 1976 directed

toward rehabilitation of all commercial quarries.* Rehabilitation may be broadly defined as the planned excavation and progressive reclamation of a mine site based on objectives of:

(i) minimizing hazards to public safety

ii) protecting the environment

(iii) optimizing the productivity of the post-mining landscape for some social or economic purpose

(iv) efficiently utilizing the available resources.

The central focus of provincial legislation is to establish controls achieving safe operation and reclamation of mines, while minimizing detrimental environmental impact. The established standards are generally minimums, which may be insufficient in special circumstances. The role of the municipality in exerciting their authority under The Planning Act should be to direct the location of future mine development, and, where necessary, establish controls above and beyond those currently enacted.

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* A commercial quarry as defined by Manitoba Regulation 226/76 means a pit or quarry from which more than 2,000 cubic yards of mineral are removed annually and which is operated for any purpose except for the personal use of an owner who is a natural person.

2.3 Mechanisms of Rehabilitation:

2.3.1 Mining Conditions:

Casual Permits and Permissions to Remove are issued subject to certain conditions which direct mining on the site and require appropriate rehabilitation. These conditions are based on strategies or rehabilitation plans prepared for each Crown pit or quarry subject to such applications.

2.3.2 Submission of Plans and Information

In the case of lease holders, and commercial mines on private property, Manitoba Regulation 226/76 requires the submission of information concerning the proposed mine operation and rehabilitation. The scope of such submissions is outlined in the attached form (Appendix I). These plans are reviewed by the Mining Engineering and Inspection Section in general consultation with local municipal officials and other government departments who provide expertise in various fields (i.e., groundwater, forestry, agriculture, highways, wildlife, etc.) or may assume responsibility for management of the post-mining landscape.

2.3.3 Enforcement

All mining activities in the Province are monitored by mines inspectors. Consultation with operators and the issue of

'orders' are means used to bring operations into compliance with The Mines Act and its regulations. The legislation provides for fines to be imposed for any contravention. In addition, commercial mine operators are required to put up a bond which is held by the Crown pending completion of the rehabilitation requirements.

3.0 Criteria for Rehabilitation

3.1 General Criteria

The evaluation of rehabilitation plans and establishment of mining conditions is generally based on the following broad criteria:

(i) any detrimental impact on the environment caused by the mine operation or the resultant mine landscape will be minimized to an acceptable level by controlling the extent and/or phasing of the operation and by implementing appropriate remedial measures

(ii) the operation of the mine and the reclamation of the landscape will mitigate any undue hazards to public safety

(iii) efficient use will be made of topsoil, overburden and reject material to facilitate progressive reclamation which will accommodate an appropriate end use.

3.2 Specific Considerations:

Within the context of such criteria, there are a wide range of specific concerns which will obviously vary from site to site. The following are a few of the major considerations:

(i) Setback:

Many of the conflicts arising from surface mining can be resolved by providing a separation distance between mine excavation or stockpiles and the property boundary. Since such restrictions may have the effect of tying up portions of a mineral deposit, this cost should be balanced against any benefits derived.

The Highways Protection Act imposes a setback of 125 feet from a department road, and 250 feet from a designated highway, subject to appeal. Regulations under The Mines Act specify a setback of 50 feet from other property boundaries, unless agreement is reached with the adjoining party. As a general minimum, a distance of 10 feet plus three times the height of an unconsolidated working face, and at

least twice the height of a consolidated working face will provide sufficient room for slope reclamation while minimizing the loss of material.

In local circumstances where a mineral deposit abuts existing development which is clearly sensitive to the characteristics of surface mining, the Municipality may want to consider the establishment of setback controls substantially exceeding those under the Provincial authority as a condition of allowing mining.

(ii) Environmental Protection:

The general criteria for protection of the environment have been established by Provincial statutes, regulations and guidelines, and are administered by various Provincial agencies. For example, the Water Rights Act regulates treatment of surface and groundwater, while emissions of noise, dust and vibration are regulated under The Clean Environment Act.

From the standpoint of surface mining, the main concern is to identify and resolve any problems before they occur, as part of a pre-planning stage. The impact of mining can be substantially reduced where it is subject to requirements for additional setback, berms, tree screens and/or careful phasing

of the operation followed by slope stabilization and revegetation. The effectiveness of such mechanisms should be evaluated carefully by a municipality before consideration is given to prohibiting mining at a new location for environmental reasons. Mining is an interim land use, often of short duration. While it may be unacceptable in some circumstances, the interests of the municipality are best served by maximizing utilization of the available aggregate reserves.

(iii) Public Safety:

The creation of steep slopes and new water bodies as a result of surface mining activity poses special problems of public safety. In pits, the unconsolidated material can be re-graded to a stable and traversable angle as a component of the rehabilitation program, thereby minimizing the safety hazard. However, the cost of grade modification in quarries is often prohibitive, due to difficulties in manipulating consolidated material and the inavailability of overburden. Under this circumstance, fences, berms and signage are tools used to inform persons of the dangerous conditions and prevent inadvertent access.

(iv) End Land Use:

In some instances it will be impractical to return a mining site to its pre-mining condition, particularly in terms of biological productivity. However, it is in the public interest to promote productive use of the landscape, as opposed to accepting dereliction. There are opportunities to enhance environmental conditions for alternative uses by a by-product of the large-scale manipulation of the mine site. The central concern here is that rehabilitated slopes on the mine site are appropriate for the intended use (see Table 1), and that this intended use does not conflict with the development pattern established by the municipality.

Where a major mineral deposit is being worked, and it is expected that mining will continue for many years, designation of a specific post-mining land use may be premature. In these circumstances interim rehabilitation should be directed toward optimizing the potential for the widest range of uses foreseeable. In time the options can be narrowed to facilitate more detailed site planning.

4.0 Municipal Concerns and Policy Recommendations:

Given the limitations of any controls established on a province-wide basis under The Mines Act, it is recommended that municipalities exercise their planning authority to properly accommodate mining as a land use in the local context. The following policy objectives are suggested for this purpose:

1. In any area where a mineral deposit is located adjacent to existing development which would clearly be sensitive to the impact of surface mining, the Municipality should, in consultation with the Mineral Resources Division, enact controls limiting the extent of mining and establish appropriate conditions for operation beyond those required under The Mines Act and its regulations, which will have the effect of mitigating any undue environmental conflicts.

2. To minimize any future conflict between mineral resource exploitation and other land uses which would be sensitive to the inherent characteristics of surface mining, such sensitive land uses should not be allowed within 1000 feet of the anticipated limits of mining activity. This would include, but not be limited to, seasonal or permanent residential uses, as well as certain institutional, commercial and recreational uses.

3. All local roads which now carry high volumes of truck traffic from a surface mine, or which may be anticipated to eventually carry high volumes of truck traffic upon commencement of mining a particular mineral deposit, should be protected from any adjoining development which would be sensitive to such traffic by:

   i) precluding development of any such land uses, or

   ii) establishing setback, screening, and ingress/egress controls which would mitigate the impact of high volumes of truck traffic.

4. The mining of aggregate is recognized as a transitional and interim land use. Consideration should be given to pre-zoning a mine site for the sequential development of other activities which take advantage of opportunities inherent in the rehabilitated landscape, provided:

   i) the owner of the mine provides plans, schedules and information regarding the eventual condition of the mining site upon completion of excavation and rehabilitation;

   ii) the owner of the mine demonstrates the oppropriateness of such a use to the post-mining site and local conditions.

5. To take advantage of any opportunities inherent in the rehabilitation of local pits and quarries on Crown Land, the municipality should participate with other Crown agencies in the selection of post-mining land uses on such sites and have input to the development of appropriate rehabilitation plans.

TABLE 1

SLOPE LIMITATIONS FOR LAND USE

50% (2:1)	Can be climbed on foot, but is difficult to establish stabilizing vegetation.
30% (3:1)	Maximum slope traversed by tractor for seeding or mowing; expert ski slope; forestry, wildlife area.
20% (5:1)	Limit of economical agriculture activity, toboggan slope, beginners ski slope; maximum shore slope for easy wading.
15% (6 1/2:1)	Low density single family residential; golf course; maximum sustained slope for roads.
10% (10:1)	Single family developments (medium density) preferred maximum road slopes; limits of most commercial and industrial uses.
5% (20:1)	Preferred slope for most residential, commercial and industrial development; beaches/swimming shores.
1% (100:1)	Minimum slope to ensure surface drainage.

APPENDIX III

EXAMPLES OF AGGREGATE RESOURCE DATA AVAILABLE FOR THE WINNIPEG RIVER PLANNING DISTRICT

L.G.D. of Alexander

Deposit number	Genetic type	Reserves Remaining '000's (Cu.M)	Comments	Planning Status	Sample Number	Percent Stone + #4 Sieve + 4.76 mm	Crushable on site	Percent Precambrian clasts 4-16 mm	
4401	2a	52	very sandy	Go	HG602	10		25	
4402	2a	23	sterilized by road	Go					1 m pebbly sand
4403	2b	21	sterilized by road	Caution	HG605	60		28	pit: intermittent; 2 m
4404	2b	60	sterilized by road	Caution	HB024	44		48	1.5 m gravel over sand
4405	1c	76	Highways tested	Stop					
4406	2b	61	garbage dump; 3 m high-quality gravel	Stop	HG636	45		22	pit: intermittent
4407	1b	34	Birchwood Motel - untested in north half	Stop/ Caution	HG616	33		87	pit: intermitent
4408	2b	64	shallow, sandy	Caution	HG614	30		40	pit: unvegetated
					HG613	39		38	pit: active, near depletion
4409	2b	40	1 m pebble gravel over sand	Caution					
4410	1b	826	4 m high quality gravel in north and south, sandier to east	Stop	HG611A	29		75	pit: extensive, depleted to east
					HG611B	35		95	intermittent use in north and west
					HG612A	38		70	pit: intermittent
					HG612B	23		74	
					HG637	35		81	pit: revegetated
					HB078	46		90	
					HB079	35		78	
4411	2a	14	1 m pebble gravel over sand	Caution					
4412	1c	51	Highways tested	Stop					
4413	1b	113	5 m variable material - from pebble gravel to silt	Stop	HG608	24		70	pit: active
					HB022	21		64	
				Caution	HB620	19		91	pit: near depletion
4415	2b/1b	2371	extremely coarse in north, finer to south;	Stop	HG607	50		87	pit: intermittent
					HG621	47		69	pit: revegetated
					HG62?	1		30	pit: very sandy, depleted
					HG623	63		65	pit: 10 m interbedded sand and pebble gravel
					HB001	46		79	
					HB002	52		68	
					HB003	39		58	
					HB004	54		64	
					HB008	51		70	
					HB006	67		64	

Deposit number	Genetic type	Reserves Remaining '000's (Cu.M)	Comments	Planning Status	Sample Number	Percent + #4 Sieve + 4.76 mm	Stone Crush able on site	Percent Precambrian clasts 4-16 mm	
					HB010	22		56	
					HB012	28		60	
					HB013	56		60	
					HB015	23		67	
					HB016A	28		62	
					HB016B	76		69	
					HB017	59		65	
					HB018	51		63	
					HB019	71		62	
					HB019	71		62	
					HB020	57		66	
4416	2b	78	sandy to north-east	Caution	HG624	45		58	pit: temporary
					HB014	25		58	
4417	1b	58	1 m cobble gravel over sand	Caution	HG619	32		96	pit: revegetated
4418	1b	98	3 large pits, revegetated, best gravel in south	Stop	HB618	11		96	
					HB089	49		83	
4419	2a	16	mapped from airphoto	Caution					
4420	2a	29	minor gravel	Caution	HB093	12		74	
4421	1b	684	Grand Beach Park	Caution	HG621	57		78	pit: garbage dump
4422	2a	33	" " "	Caution					
4423	2b	18	shallow, near depletion	Caution	HG660	62		76	pit: inactive
4424	2a	54	subdivisions	Go					
4425	2a	29	not tested	Caution					
4426	2b	25	sandy, shallow	Caution	HG662	50		66	pit: revegetated
4427	1b	372	3 m interbedded sand and gravel	Stop	HG628	53		51	pit: active
4428	1b	25	borrow pits near depletion	Caution					
4429	2b	69	sandy	Stop					
4431	2b	183	1 m gravel over pebbly sand	Caution	HB070	31		82	
4432	2a	34	not tested	Caution					
4433	2b	238	at least 3 m good quality aggregate	Stop	HG634	25		91	
					HB063	34		75	
					HB064	35		86	
4434	2b	745	2 m gravel over sand in south; overlies glaciofluvial gravels in north	Stop	HG630	44		73	pit: recently active
					HB037	57		78	pit: revegetated
					HB038	35		70	
					HB039	62		81	
					HB049	40		91	
					HB050	37		87	
					HB053	35		85	

L.G.D. of Alexander - Cont'd. - 3

Deposit number	Genetic type	Reserves Remaining '000's (Cu.M)	Comments	Planning Status	Sample Number	Percent + #4 Sieve + 4.76 mm	Percent Stone Crushable on site	Percent Precambrian clasts 4-16 mm	
4435	1b	1595	8 m gravel at MG633	Stop	MG632	47		83	pit: inactive
					MG633	39		89	pit: intermittent
					MB051	47		82	
4436	2b/1b	495	2-3 m pebble gravel	Stop	MB044	70		73	
					MB045	48		68	
					MB046	57		69	
					MB047	54		70	
4437	1b	140	4 m sand, gravel, boulders	Stop					
4438	2b	603	3 m pebble gravel in south; overlies glaciofluvial gravel in north	Stop	MB058	48		73	
4439	2b	170	3 m sand and pebble gravel	Stop	MB059	47		79	
					MB060	28		77	
4411	2a	211	no access	Caution					
4412	2a	52	sterilized by farmstead	Go					
4443	2a	53	1 m sandy pebble gravel	Caution					
4444	2a	60	not tested	Caution					
4445	1c	8	pit near depletion	Caution	MG640	38		66	pit: revegetated
4446	2b	61	2 m sandy pebble gravel	Caution					pit: revegetated
4447	2b	67	shallow deposit	Caution	MG643	54		24	pit: revegetated
4448	2b	47	very sandy	Caution	MG609A	33		28	pit: intermittent; pit in
					MG609B	25		31	Sec. 11 depleted
4449	1c	13	little gravel remaining on east side of deposit	Caution	MG659C	51		100	pit: near depletion
4450	2b	61	only gravel within 25 km	Stop	GM509	44		85	pit: intermittent
					GM510	44		75	pit: revegetated
4451	2b	59	only gravel within 25 km	Stop	GM507	30		90	pit: revegetated
					GM508	54		90	pit: intermittent
4452	1b	197	north end Gull Lake deposit	Stop					
4453	1b	38	winter access only	Caution					
4454	1b	24		Caution					pit: last visit 1978

Total Reserves: 10 609

Stop Reserves: 8 377